CALIFORNIA OFFSHORE OIL AND GAS DECOMMISSIONING OUTLOOK AND CHALLENGES

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ACKNOWLEDGEMENTS

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The Challenges Facing the Industry in Offshore Facility Decommissioning on the California Coast

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TOPICS COVERED

1. Federal and state water facilities and their operating status.
2. Decommissioning status and outlook.
3. Decommissioning challenges
4. Risk adjusted decommissioning cost estimates.

FEDERAL OCS PLATFORMS

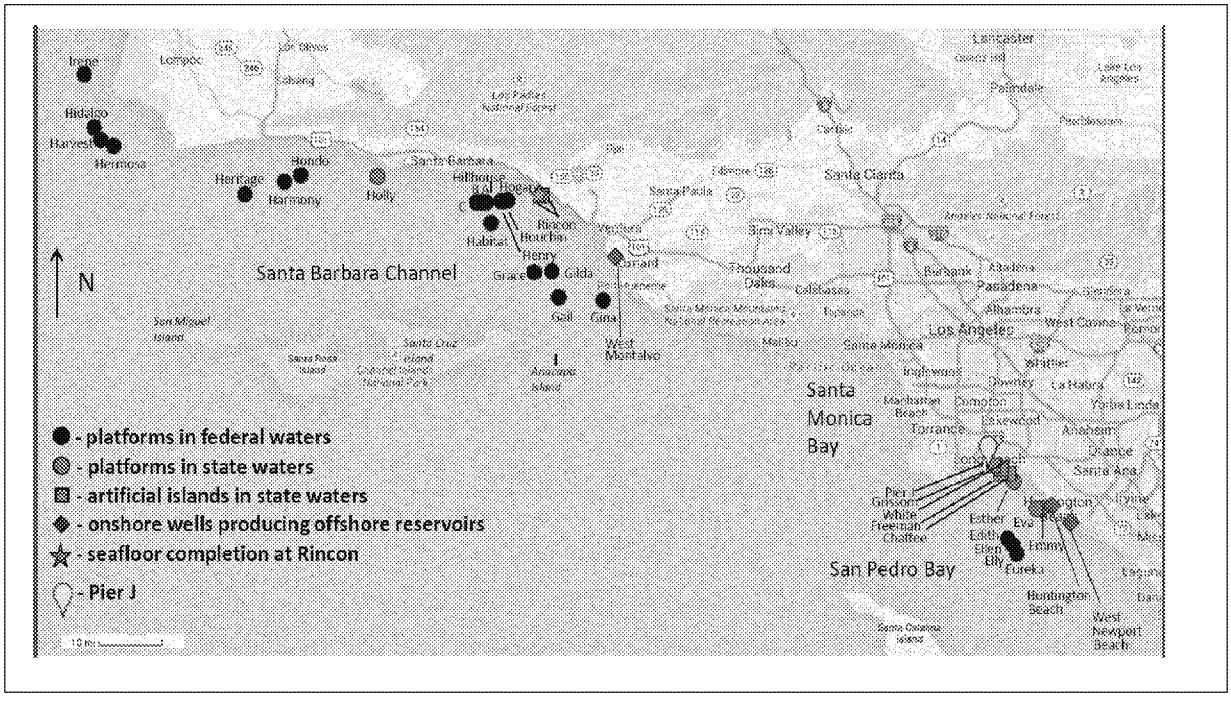
- 23 OCS platforms (all fixed steel jacket structures)
- 750 wells
- Age Range 28 – 50 years
- Water depth 95’ – 1,198’
- Weight 1,380 – 86,513 tons
- Operating Status
  - 14 producing
  - 9 shut-in
  - 5 being decommissioned

FEDERAL OCS PLATFORMS LOCATED OFFSHORE CALIFORNIA							
Platform	Year Installed and Age (years)		Operating Status Jan. 2018	Water Depth (feet)	Total Weight (s. tons)	Wells	OCS Operator
San Pedro Bay - Los Angeles and Orange County							
Eureka	1984	33	Producing	700	33,377	50	EOG
Elly*	1980	37	Active	255	9,400	0	EOG
Ellen	1980	37	Producing	265	11,665	63	EOG
Edith	1983	34	Producing	161	8,556	18	DCOR
Eastern Santa Barbara Channel - Ventura and Santa Barbara County							
Hogan	1967	50	Producing	154	5,098	39	POO
Houchin	1968	49	Producing	163	5,615	35	POO
A	1968	49	Producing	188	4,896	52	DCOR
B	1968	49	Producing	190	4,959	57	DCOR
C	1977	33	Producing	192	5,718	38	DCOR
Henry	1979	38	Producing	173	4,006	23	DCOR
Hillhouse	1969	48	Producing	190	5,834	47	DCOR
Gina	1980	37	Producing	95	1,380	12	DCOR
Gilda	1981	36	Producing	205	11,293	63	DCOR
Habitat	1981	36	Shut-in	290	9,611	20	DCOR
Grail	1987	30	Shut-in	739	37,057	27	EXXM
Gilda	1979	38	Shut-in	318	13,074	28	EXXM
Western Santa Barbara Channel - Santa Barbara County							
Irene*	1976	41	Shut-in	842	29,478	28	EML
Harmony	1989	28	Shut-in	1,198	86,513	34	EML
Heritage*	1989	28	Shut-in	1,075	69,192	48	EML
Santa Maria Basin - Santa Barbara County							
Hermosa	1985	32	Shut-in	675	35,150	19	FMcOG
Hidalgo	1985	32	Shut-in	603	30,868	13	FMcOG
Irene	1986	31	Shut-in	430	23,384	14	FMcOG
Gaviota	1987	30	Producing	262	9,737	20	FMcOG

STATE WATER FACILITIES

- 4 platforms (all fixed steel jacket structures)
- 5 artificial islands
- 1,750 well slots
- Age Range 32 - 59 years
- Water depth 22' - 57' except Platform Holly (211' wd)
- Operating Status
  - 7 producing
  - 2 being decommissioned (Platform Holly and Rincon Island)

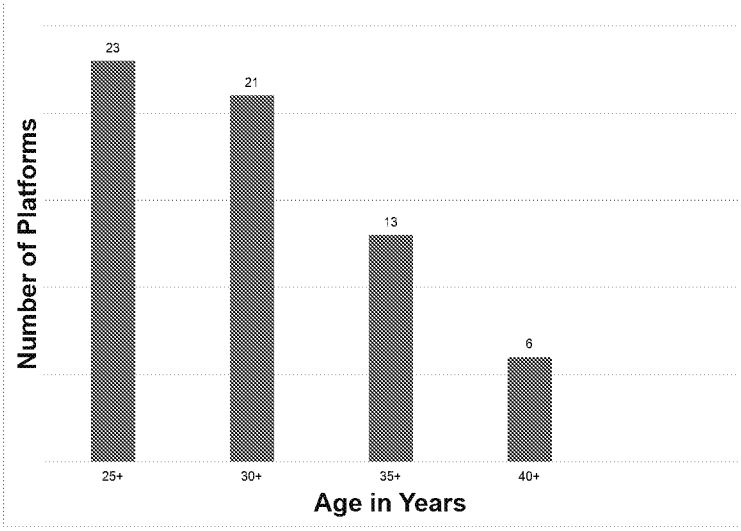
OIL AND GAS PRODUCTION FACILITIES LOCATED IN CALIFORNIA STATE WATERS							
Platforms	Year Installed and Age (years)		Water Depth (feet)	Location	Current Status	Well Slots	Operator
Emmy	1963	54	47	Huntington Beach, Orange County	Producing	64	Beta Petroleum Corp.
Eva	1964	53	57	Huntington Beach, Orange County	Producing	44	Beta Corp.
Esther	1985	32	22	Seal Beach, Los Angeles County	Producing	64	Beta Corp.
Irene	1966	51	211	Goleta, Santa Barbara County	Shut-in	30	Beta Petroleum Corporation (Pacific)
Artificial Islands							
Chaffee	1966	51	40	Long Beach, Los Angeles County	Producing	387	Beta Long Beach Company
Freeman	1966	51	40	Long Beach, Los Angeles County	Producing	357	Beta Long Beach Company
Grissom	1966	51	40	Long Beach, Los Angeles County	Producing	338	Beta Long Beach Company
Gilmore	1966	51	40	Long Beach, Los Angeles County	Producing	394	Beta Long Beach Company
Rincon	1958	59	44	Ventura County	Shut-in	69	Beta Offshore (previously Shell Rincon Island Limited)


Irene
Hidalgo
Harvest
Hermosa
Heritage
Harmony
Rincon
Holly
Santa Barbara Channel
N
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island
Gail
Gina
West Montalvo
Santa Clarita
Santa Paula
Ventura
Simi Valley
Thousand Oaks
Burbank
Pasadena
Los Angeles
Santa Monica Bay
Torrance
Long Beach
Anaheim
Santa Ana
Irvine
Huntington Beach
West Newport Beach
San Pedro Bay
Pier
Gilson
White
Freeman
Chaffee
Esther
Edith
Ellen
Elly
Eureka
Eve
Emmy
- platforms in federal waters
- platforms in state waters
- artificial islands in state waters
- onshore wells producing offshore reservoirs
- seafloor completion at Rincon
- Pier J

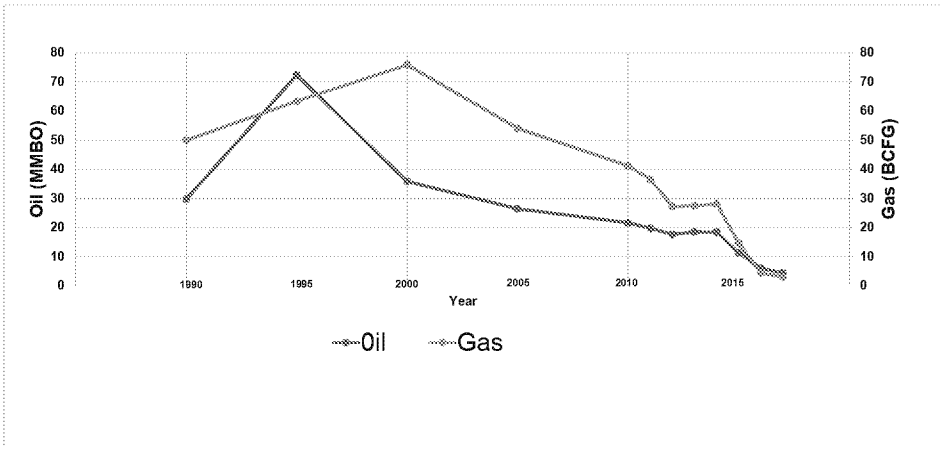
CESSATION OF PRODUCTION LEADING INDICATORS

1. Age of facilities
2. Major long term declines in production
3. Prolonged shut-ins
4. Bankruptcies

THE AGE RANGE OF CALIFORNIA OCS PLATFORMS



CALIFORNIA OCS OIL AND GAS PRODUCTION 1990 - 2017



CA OCS PRODUCTION HISTORY

• Peak production:	72.4 MBO (1995)	75.0 BCFG (2000)
• 2014 production:	18.4 MBO	28.2 BCFG (pre 901 break)
• 2015 production:	11.4 MBO	14.7 BCFG (post 901)
• 2016 production:	6.1 MBO	4.5 BCFG.
• 2017 production:	4.5 MBO	3.1 BCFG.

- Absent new leasing, exploration and development activity the general downward trend is expected to continue.

SHUT-IN FEDERAL OCS PLATFORMS LOCATED OFFSHORE CALIFORNIA							
Platform	Year Installed	Age (years)	Operating Status Jan. 2018	Water Depth (feet)	Total Weight (s. tons)	Wells	OCS Operator
Habitat	1981	36	Shut-in	290	9,611	20	DCOR
Gail	1987	30	Shut-in	739	37,057	27	BWEE
Grace	1979	38	Shut-in	318	13,074	28	BWEE
Houchin	1976	41	Shut-in	842	29,478	28	EMC
Harmony	1989	28	Shut-in	1,198	86,513	34	EMC
Heritage	1989	28	Shut-in	1,075	69,192	48	EMC
Hermosa	1985	32	Shut-in	675	35,150	19	FMCOG
Hidalgo	1985	32	Shut-in	603	30,868	13	FMCOG
Irene	1986	31	Shut-in	430	23,384	14	FMCOG

DECOMMISSIONING PROJECTS

- State Water Projects
  - Platform Holly (approx. 9,000 tons; 211' wd)
  - Rincon Island (49 wells; 44' wd)
- OCS Project
  - Platform Grace (13,074 tons; 318' wd)
  - Platform Gail (37,057 tons; 739' wd)
  - Harvest, Hermosa, Hidalgo (23,000 – 35,000 tons; + 600' wd.)
- First platform projects since 1996 Chevron 4-H project
- Possible domino effect?

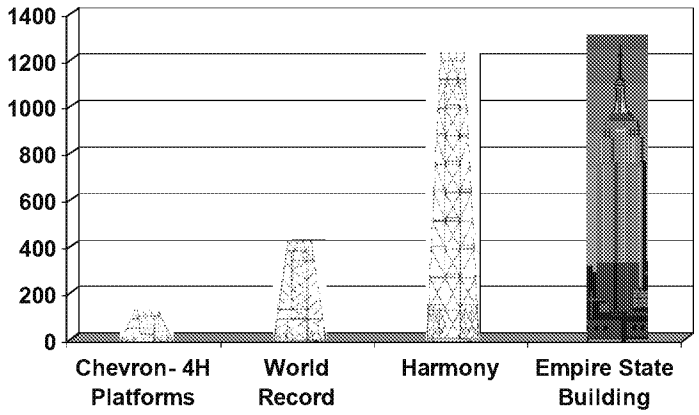
CALIFORNIA DECOMMISSIONING CHALLENGES

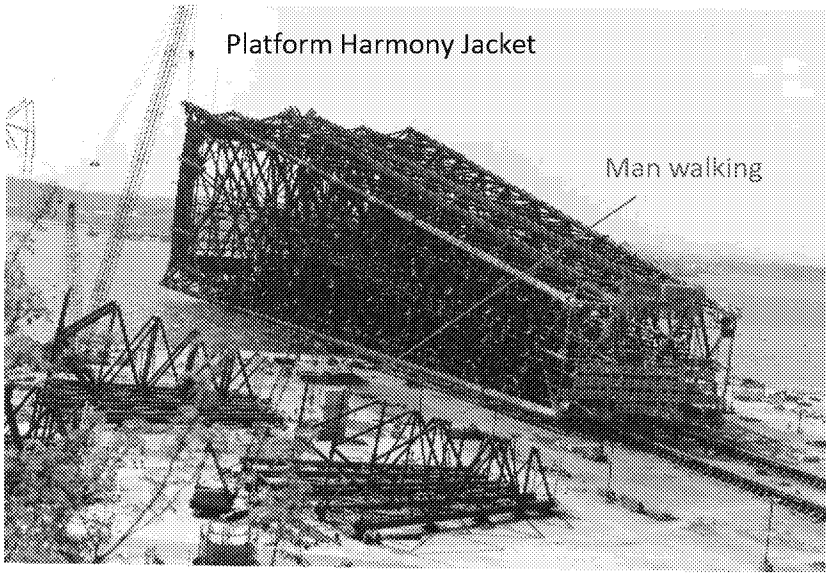
1. Limited experience & large, deep water structures.
2. Lack of infrastructure & high HLV mobilization costs.
3. Limited onshore processing & disposal options.
4. Complex regulatory framework.
5. Marine mammal protection requirements.
6. Air emission control requirements.
7. Site clearance requirements for shell mounds.
8. An untested and problematic rigs-to-reef process.

LIMITED WORLDWIDE DEEP WATER REMOVAL EXPERIENCE

- Only 15 fixed steel jacket platforms weighing +14,000 tons were reported to have been removed through 2016, nearly all UK & GOM.
- Most, most of jackets were reefed (GOM), or their footings (legs/piles) were approved to remain in-situ (UK).
- In GOM and UK, the deepest jackets reefed or partially removed were located in 350' – 470' wd.
- 8 of 23 OCS platforms are in +400"wd & weigh 23,000 – 87,000 tons.
- CA platforms will among largest ever decommissioned (wd./tonnage).

Jacket Size Comparison




Platform Harmony Jacket
Man walking

LACK OF INFRASTRUCTURE & HLV'S

- HLV's and decommissioning support services lacking
- HLV's likely mobilized from GOM, North Sea, Pacific Rim
- Mob/demob times 80 - 180 days @ day rates $165k - $550k.
- Single mob cost $12 - $73 million depending on HLV & distance
- Two or more HLV mobs may be required to remove a single deep water (+400' wd.) jacket
- New HLV *Pioneering Spirit* could be used to lift topsides and jackets in single lift – but where to offload?

LIMITED ONSHORE DISPOSAL OPTIONS

- SA Recycling (SAR) Facility in Long Beach
- Primarily processes industrial scrap (autos, rail cars)
- Chevron 4-H platforms taken to SAR (10,000 tons)
- Limited capacity and crane capability
- Removal of 3-4 deep water platforms could generate 90,000-180,000 tons of material (10-20 times Chevron 4-H)
- Major upgrades necessary for large scale projects.
- Port policy on expansion uncertain.
- Cost unknown but probably tens/hundreds of $ millions

AIR EMISSION REQUIREMENTS

- Offshore oil and gas facilities operate under permits issued by either the SBCAPCD, VCAPCD or the SCAQMD.
- Permits cover routine emissions, not decom. emissions.
- All districts are classified as non-attainment for ozone and particulate matter so strict limitations are placed on emissions.
- Compliance costs could be very high (e.g. engine retrofits)
- Early consultations will be required to determine requirements.
- Delays in obtaining permits can be costly (e.g. Chevron 4-H)

SITE CLEARANCE - SHELL MOUNDS

- Shell mounds present at many platforms.
- Can pose obstacle to trawling operations.
- Chevron 4-H shell mound issue remains unresolved.
- Options: excavate, dredge, cap, or remain in-situ and monitor.
- UK Platform North West Hutton Cost Study (2009)
  - Leave in situ and monitor $ 750,000
  - Capping $ 12 million
  - Excavate & disperse $ 12 - $14 million
  - Dredge and reinject $ 65 - $171 million
- UK practice is to leave in-situ and monitor.
- CA practice TBD but has potential to be costly

PROBLEMATIC REEFING PROCESS

- California Marine Resources Legacy Act (AB 2503) of 2010.
- Allows reefing of jackets on case-by-case basis.
- Reef must result in “net environmental benefit”.
- Cost savings must be shared (65% until 01/2023, 80% thereafter).
- Applicant must indemnify and protect state from liability.
- First applicant must cover cost of CDFW to develop program.
- Estimated cost: $4 - $6 million to set up CDFW program, and $1 - $2 million/year to manage (CA Senate Appropriations Committee).
- Amendments to AB 2503 proposed but prospects uncertain.

COST ESTIMATES FOR DECOMMISSIONING CALIFORNIA OCS OIL AND GAS PLATFORMS

- 2016 TSB cost report prepared for BSEE/BOEM estimated the total cost to decommission the 23 CA OCS to be approximately **$1.5 Billion**.
- The objective of that study was to estimate the lowest likely cost for the purpose of operator bonding with no consideration of the challenges (risks).
- A major objective of the OTC paper was to identify the risks and how they might impact the cost.
- We concluded that the total cost could easily be off by a factor of 5 or more, i.e., the total cost may be greater than **$7.8 Billion**.

THE ESTIMATED COST OF DECOMMISSIONING THE POCSR FACILITIES WITH RISK (Mean in US$ Millions)									
Platform Depth Range	Platform Removal w/ Risk	Well P&A w/ Risk	Conductor Removal w/ Risk	Permitting & Reg. Compliance w/ Risk	Mob & Demob w/ Risk	Materials Disposal w/ Risk	Other Costs w/ Risk	Mean Total Cost w/ Risk	Total Cost (BSEE 2016)
<200 feet	116	102	51	30	62	99	151	611	272
200 - 400 feet	118	74	41	18	40	141	154	586	241
400 - 800 feet	1,131	52	61	21	95	1,667	269	3,296	495
>800 feet	944	57	79	13	103	1,836	231	3,263	459
Total	2,309	285	232	82	300	3,743	805	7,756	1,467

SUMMARY

1. Offshore decommissioning will be a very challenging and expensive process in California.
2. Cost Risk (underestimation/cost overrun) is high due to technical and engineering challenges, lack of infrastructure, and regulatory requirements and uncertainties.
3. TBS 2016 decommissioning cost estimates for CA OCS facilities should be viewed as conservative because they represent best case, risk-free estimates.